

it pointed to the need for a bridge to a study of cell structures. Making this connection, however, required appropriate techniques to study cell structures at the appropriate level of organization, which were only in the process of being developed.

### 3. THE NEED TO ENTER THE TERRA INCOGNITA BETWEEN CYTOLOGY AND BIOCHEMISTRY

In this chapter, I have focused on what cytology and biochemistry were able to contribute to an understanding of how cells performed several important functions of life prior to 1940. After a promising start in the late nineteenth century, cytology stalled in the twentieth century. The chief problem was that cytologists' main tool, the light microscope, could not reveal the details of the internal structures in cell cytoplasm. Beyond the rather crude attempts to correlate structures with activities cells were performing, cytologists on their own could not address the function of these structures. Working at a lower level of organization, biochemists were making great progress in unraveling chemical mechanisms involved in cell processes such as fermentation and cellular respiration. Their main strategy for securing preparations for their investigations, homogenation, destroyed any cell structure, making contact with cytological research difficult.

By 1940, several researchers from both cytology and biochemistry recognized the potential for linking their inquiries. The first edition of Geoffrey Bourne's *Cytology and Cell Physiology* in 1942 bears witness to this desire. Nonetheless, there remained unexplored territory between reconstituted chemical pathways and what could be observed through the light microscope about the structure and behavior of cells. There had been pioneering efforts, especially in the developing fields of cytochemistry and histochemistry, that gave hope of localizing processes within cells and understanding just how structure and function related. But truly productive exploration of this territory required new tools. Two tools that were to be immensely important in exploring this territory were being applied to cells for the first time around 1940 – the ultracentrifuge and the electron microscope. Each gave rise to a problem already noted several times in this chapter: Were the results obtained with the new instruments providing real information about cells or were they merely producing artifacts? This is the topic of the next chapter.